REMARKS

The present amendment is in response to the Office Action mailed on April 23, 2003 relating to claims 1-8. Applicants have thoroughly reviewed the outstanding Office Action including the Examiner's remarks and the references cited therein. The following remarks are believed to be fully responsive to the Office Action and, when considered with the amendments made herein, are believed to render all claims at issue patentably distinguishable over the cited references.

Claims 1, 3-8 are amended herein. Claim 2 is cancelled. Claim 17 is a new claim. Accordingly, Claims 1 and 3-9 are pending.

All the changes are made for clarification and are based on the application and drawings as originally filed. It is respectfully submitted that no new matter is added.

CLAIM AMENDMENTS – IN GENERAL

Claim 2 is cancelled, and the limitations have been incorporated in amended Claim 1. Claim 1 is believed to particularly point out and distinctly claim the present invention. Claims 3-8 are amended to change the number of the independent claim from which they depend, Claim 5 is amended to point out that the aluminum content in each of the hardly oxidized semiconductor layers is low (see page 8 lines 2-3 of the specification). Moreover, new independent Claim 17 includes all of limitations as recited in Claims 5-7.

CLAIM REJECTIONS - 35 U.S.C. SECTION 103

Claim 1 has been rejected under 35 U.S.C. 103(a), as unpatentable over Komoto et al. (US Patent No. 6,340,824). Claims 2-8 have been rejected under 35 U.S.C. 103(a), as

unpatentable over by Komoto et al. in view of Coldren et al. (US Patent No. 5,877,038), Duveneck et al. (US Patent No. 6,469,785), and Ebeling et al. (US Patent No. 6,455,010).

All of the pending rejections are respectfully traversed. As will be more fully explained below, it is respectfully submitted that Komoto et al.; and Komoto et al. in view of Coldren et al., Duveneck et al. and Ebeling et al. fail to teach the claimed invention. Accordingly, Applicants respectfully request that the rejection under 35 U.S.C. §103(a) be withdrawn.

With respect to Claim 1, the Examiner states that Figure 100 of Komoto et al. shows a light emitting diode having a substrate 2012, 2014, a reflecting layer RE2, an LED epitaxial structure 2016-2024 with n-type layer 2016, 2018, active layer 2020, and p-type layer "20222" (sic be 2022), 2024 (column 40, lines 58-62), wherein the material may be III-V compound semiconductors (column 40, line 64 through column 41, line 21). Further, first and second electrodes on exposed are said to be shown portions of the n and p layers in the figure, and Column 44, line 10, states that the reflecting layer RE2 may be a Bragg reflecting mirror. In view of the above, the Examiner concludes that it would have been obvious to use a Bragg reflector as layer RE2 because this is what the reference teaches, and because such a reflector has well-known desirable properties.

With respect to Claim 2, the Examiner states that Komoto et al. teaches a Bragg layer of AlN/InN, where the AlN is oxidizable (because of the large amount of Al)and the InN is hardly oxidized (because it is InN and not an oxidable compound). With respect to Claims 2 and 5 –7, the Examiner states that Duveneck et al. teach a Bragg reflector of $Al_{0.9}Ga_{0.1}As$ and $Al_{0.3}Ga_{0.7}As$.

However, in Column 42, lines 51-58, Komoto et al. lists AlN/InN together with the combinations of such as SiO_2 and TiO_2; and a thin film made of any one of these materials and a thin film of aluminum gallium arsenide, aluminum gallium phosphide, tantalum

pentoxide, polycrystalline silicon or amorphous silicon, wherein both layers forming the Bragg layer can be all oxidizable (such as SiO_2 and TiO_2). Komoto et al. does not teach that two adjacently stacked films forming the Bragg layer have different degrees of oxidation capability. In contrast to the foregoing, the Applicants invention (Claim 1) provides a reflector layer having an alternately stacked oxidizable semiconductor layers and hardly oxidized semiconductor layers (wherein the oxidizable semiconductor layers are easier to oxidize than the hardly oxidized semiconductor layers.). Komoto et al. neither teaches, suggests, nor provides any instructions to oxidize only some films of the reflecting layer RE2 as current insulating layers. For this reason, Komoto et al. does not render the invention of Claim 1 obvious.

With respect to Duveneck's teachings relating to Claim 2 (now cancelled), the rationale of Duveneck et al. using $Al_{0.9}Ga_{0.1}As$ and $Al_{0.3}Ga_{0.7}As$ to form a Bragg reflector is not to form current insulating layers by directly oxidizing $Al_{0.9}Ga_{0.1}As$ and $Al_{0.3}Ga_{0.7}As$ layers, but rather to replace one of the $Al_{0.9}Ga_{0.1}As$ layers by an AlAs layer in order to create a layer having an increased anisotropic etching behavior, thereby constricting the current path at a location deeper within the surface-side Bragg mirror. This location is determined by the AlAs layer which has an increased anisotropic etching behavior in comparison with the other layers (see Column 11, lines 2-15). Therefore, Duveneck et al. does not provide any motivation to use $Al_{0.9}Ga_{0.1}As$ and $Al_{0.3}Ga_{0.7}As$ as the materials forming the oxidizable semiconductor layers and the hardly oxidized semiconductor layers as recited in the claimed invention, and thus the method of constricting the current path (isolating the current) adopted by Duveneck et al. is different from Applicants' method.

With respect to Ebeling's teaching, the Examiner states that lateral oxidation of an AlGaAs layer is taught by Ebeling in order to make the layer an insulator. However, since Ebeling et al. merely disclose the lowest layer of the p-doped Bragg reflector 2, where the

lowest layer is not oxidized to Al_xO_Y over its entire surface but has a non-oxidized zone 13 in the central region, Ebeling et al. does not disclose the bragg reflector layer formed by alternately stacking oxidizable semiconductor layers and hardly oxidized semiconductor layers. Moreover, the entire structure disclosed by Ebeling et al. is extremely different than the applicants' structure, and hence, Ebeling et al. does not provide any motivation to one skilled in the art to construct the invention of presently amended claim 1.

With regard to Claims 3-8, since Claim 1, as well as new Claim 17, is believed patentable over the prior art of record, dependent Claims 3-8 depending from independent Claim 1 are likewise patentable. Accordingly, the applicants respectfully request that the section 103(a) rejection be withdrawn.

CONCLUSION

In light of the above remarks, the applicants respectfully submit that claims 1, 3-9 as currently presented are in condition for allowance and hereby requests reconsideration. The applicants respectfully request the Examiner to pass the case to issue at the earliest convenience.

Respectfully submitted,

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MARKUP VERSION SHOWING CHANGES MADE

IN THE CLAIMS:

1. (Currently Amended) A structure of a light emitting diode (LED), comprising:

a substrate;

a bragg reflector layer located on said substrate, wherein said bragg reflector comprises:

a plurality of oxidizable semiconductor layers, wherein each of said plurality of oxidizable semiconductor layers is oxidized to form a current insulating layer; and

a plurality of hardly oxidized semiconductor layers, wherein said plurality of oxidizable semiconductor layers and said plurality of hardly oxidized semiconductor layers are alternately stacked on each other, wherein said plurality of oxidizable semiconductor layers are easier to oxidize than said plurality of hardly oxidized semiconductor layers ;

an LED epitaxial structure located on said bragg reflector layer, wherein said LED epitaxial structure comprises an n-type III-V compound semiconductor layer, an illuminating active layer, and a p-type III-V compound semiconductor layer;

a first electrode located on an exposed portion of said n-type III-V compound semiconductor layer; and

a second electrode located on an exposed portion of said p-type III-V compound semiconductor layer.

3. (Currently Amended) The structure according to claim [2]1, wherein said plurality of hardly oxidized semiconductor layers in said bragg reflector layer are AlGaInP layers.

4. (Currently Amended) The structure according to claim [2]1, wherein said plurality of hardly oxidized semiconductor layers in said bragg reflector layer are AlInP layers.

5. (Currently Amended) The structure according to claim [2]1, wherein said plurality of hardly oxidized semiconductor layers in said bragg reflector layer are low aluminum-contained AlGaAs layers.

6. (Currently Amended) The structure according to claim [2]1, wherein said plurality of oxidizable semiconductor layers in said bragg reflector layer are high aluminum-contained AlGaAs layers.

7. (Currently Amended) The structure according to claim [6]1, wherein the aluminiferous content of said high aluminum-contained AlGaAs layers are between about 80% and about 100%.

8. (Currently Amended) The structure according to claim [6]1, wherein [a]said current insulating layer is formed by oxidizing each of said high aluminum-contained AlGaAs layers at a temperature between about 300 and about 800 degree C.

17. (New) A structure of a light emitting diode (LED), comprising:

a substrate;

a bragg reflector layer located on said substrate, wherein said bragg reflector comprises:

a plurality of oxidizable semiconductor layers, wherein each of said plurality of oxidizable semiconductor layers is oxidized to form a current insulating layer, and said

plurality of oxidizable semiconductor layers are high aluminum-contained AlGaAs layers, wherein the aluminiferous content of said high aluminum-contained AlGaAs layers are between about 80% and about 100%; and

a plurality of hardly oxidized semiconductor layers, wherein said plurality of oxidizable semiconductor layers and said plurality of hardly oxidized semiconductor layers are alternately stacked on each other, wherein said plurality of oxidizable semiconductor layers are low aluminum-contained AlGaAs layers ;

an LED epitaxial structure located on said bragg reflector layer, wherein said LED epitaxial structure comprises an n-type III-V compound semiconductor layer, an illuminating active layer, and a p-type III-V compound semiconductor layer;

a first electrode located on an exposed portion of said n-type III-V compound semiconductor layer; and

a second electrode located on an exposed portion of said p-type III-V compound semiconductor layer.